

Appl. No. : 10/619,796
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AMENDMENTS TO THE CLAIMS

IN THE CLAIMS:

A complete set of claims is provided below.

1. (Currently Amended) A method of data compression, comprising:
 - partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to one unknown in a system of linear equations, each of said basis functions corresponding to an original source;
 - selecting a plurality of spherical angles;
 - calculating a far-field disturbance produced by each of said basis functions in a first group for each of said spherical angles to produce a matrix of transmitted disturbances;
 - using a computing system, reducing a rank of said matrix of transmitted disturbances to yield a second set of basis functions, said second set of basis functions corresponding to composite sources, each of said composite sources comprising a linear combination of one or more of said original basis functions;
 - partitioning a first set of weighting functions into groups, each group corresponding one of said regions, each weighting function corresponding to a condition, each of said weighting functions corresponding to an original tester;
 - calculating a far-field disturbance received by each of said testers in a first group for each of said spherical angles to produce a matrix of received disturbances;
 - reducing a rank of said matrix of received disturbances to yield a second set of weighting functions, said second set of weighting functions corresponding to composite testers, each of said composite testers comprising a linear combination of one or more of said original testers **wherein said matrix of transmitted disturbances and said matrix of received disturbances are not identical;**
 - transforming said system of linear equations to use said composite sources and said composite testers;
 - identifying a plurality of sub-matrices in said transformed system of linear equations; and

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operating on said plurality of sub-matrices to solve said transformed system of linear equations.

2. (Currently Amended) A method for factorization of an interaction matrix describing physical effects due to electric charges, comprising:

identifying one or more small-valued elements of an interaction matrix describing physical effects due to electric charges;

setting said one or more small-valued elements to zero;

identifying one or more first sub-blocks in said interaction matrix, said first second sub-blocks containing non-zero elements;

identifying one or more second sub-blocks in said interaction matrix, said second sub-blocks containing all zero elements; and

using a computing system, applying producing a decomposition to of said interaction matrix by performing matrix operations on said first sub-blocks wherein said decomposition contains a plurality of alpha sub-blocks corresponding to a plurality of said first sub-blocks;

said decomposition contains a plurality of beta sub-blocks corresponding to a plurality of said second sub-blocks said beta sub-blocks containing all zero elements; and

storing said decomposition on a computing system.

3. (Original) The method of Claim 2, wherein said decomposition comprises an LU decomposition.

4. (Original) The method of Claim 2, wherein said decomposition comprises matrix inversion.

5. (Original) The method of Claim 2, wherein said decomposition comprises an LDM decomposition.

6. (Original) The method of Claim 2, wherein at least one of said matrix operations is performed using optimized software.

7. (Original) The method of Claim 2, wherein either decompositions of first sub-blocks for a first block row below the main diagonal of said interaction matrix are substantially computed before decompositions on a second block row or a substantial number of

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decompositions of first sub-blocks for a first block column to the right of the main diagonal of said interaction matrix are substantially computed before decompositions on a second block column.

8. (Original) The method of Claim 2, wherein said factorization permits direct solution of a system of linear equations and wherein said direct solution comprises the division by a pivot.

9. (Currently Amended) A method device, comprising:

using a computing system, generating a processor means configured to generate a block-sparse matrix containing substantially full diagonal blocks and containing more than one substantially sparse block where said more than one substantially sparse block contain non zero elements in substantially similar locations; and

identifying wherein said processor means is further configured to identify one or more sub-blocks in said block-sparse matrix, said sub-blocks containing a plurality of non-zero elements; and

a storage means configured to store said block-sparse matrix; and

applying a processor means configured to apply a decomposition to said block-sparse matrix using said sub-blocks as a sub-matrix to produce a block-sparse decomposed matrix, wherein said processor means uses the sparse nature of said block sparse matrix and said sparse decomposed matrix uses said storage means to efficiently apply said decomposition and wherein said block-sparse decomposed matrix contains more than one substantially sparse block wherein said more than one substantially sparse block contain non zero elements in substantially similar locations.

10. (Currently Amended) The method device of Claim 9, wherein said decomposition comprises an LU decomposition.

11. (Currently Amended) The method device of Claim 9, wherein said decomposition comprises matrix inversion.

12. (Currently Amended) The method device of Claim 9, wherein said decomposition comprises an LDM decomposition.

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13. (Currently Amended) The method device of Claim 9, wherein at least one operation using said sub-blocks as a sub-matrix comprises running optimized decomposition software.

14. (Currently Amended) The method device of Claim 9, wherein said decomposition decomposed matrix permits direct solution of a system of linear equations without further division by a pivot.

15. (Previously presented) The method of Claim 2, further comprising: generating said interaction matrix from a first matrix, wherein said interaction matrix is relatively more sparse than said first matrix, and wherein the generation of said interaction matrix uses numerical interaction data.

16. (Previously presented) The method of Claim 15, wherein said using said interaction matrix comprises reducing a rank.

17. (Currently Amended) The method device of Claim 9, wherein said generating to generate a block sparse matrix comprises using a matrix of disturbances.

18. (Currently Amended) The method device of Claim 17, wherein a first block of said more than one substantially sparse blocks block of said block-sparse matrix is generated at least in part by reducing a rank of a matrix of disturbances.

19. (Currently Amended) The method device of Claim 18, wherein said first block contains interactions not described by said matrix of disturbances.

20. (Currently Amended) The method device of Claim 19, wherein one or more interactions described in said first block are described by said matrix of disturbances.

21. (Currently Amended) A method of data compression, comprising:
partitioning a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to an unknown in a system of equations, each of said basis functions corresponding to an original source;

each original source corresponding to an energy source;

selecting a plurality of spherical angles;

calculating a far-field disturbance produced by each of said basis functions in a first group for each of said spherical angles to produce a matrix of containing transmitted disturbances;

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using a computing system, reducing a rank of said matrix ~~of containing~~ transmitted disturbances to yield a second set of basis functions, said second set of basis functions corresponding to composite sources, each of said composite sources comprising a linear combination of one or more of said original basis functions;

transforming ~~said a~~ system of linear equations to use said composite sources; identifying a plurality of sub-matrices substantially column-wise disposed to each other in said transformed system of linear equations;

operating on said plurality of sub-matrices to compute a decomposition, and wherein said decomposition is substantially comprised of second sub-matrices, each of said second sub-matrices corresponding to composite sources produced by reducing a rank of a ~~first~~ matrix containing transmitted disturbances; and

using said decomposition to solve said transformed system of linear equations to produce the strengths of said energy sources.

22. (Currently Amended) A computing system configured to produce a compressed solution of a system of linear equations comprising:

partitioning a processor means configured to partition a first set of basis functions into groups, each group corresponding to a region, each basis function corresponding to one unknown in a system of linear equations, each of said basis functions corresponding to an original source, each of said original sources corresponding to a physical disturbance;

calculating a processor means configured to calculate a plurality of far-field disturbances produced by each of said basis functions in a first group to produce a plurality of transmitted disturbances;

~~on a computing system, using a processor means configured to use~~ said plurality of far-field disturbances to yield a second set of basis functions, said second set of basis functions corresponding to a plurality of composite sources, each of said composite sources comprising a linear combination of one or more of said original basis functions; ~~transforming said interaction data to produce a second system of linear equations using said composite sources, wherein a portion of said second system of linear equations is compressed relative to said system of linear equations, said a~~

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~~portion using said composite sources, and wherein said plurality of far-field disturbances contains disturbances that are not described by said interaction data;~~

a processor means configured to transform said interaction data to produce a second system of linear equations using said composite sources, wherein a portion of said second system of linear equations is compressed relative to said system of linear equations, said a portion using said composite sources, and wherein said plurality of far-field disturbances contains disturbances that are not described by said interaction data;

a storage means configured to store a compressed portion of said second system of linear equations;

operating a processor means configured to operate on said transformed system of linear equations to compute a factorization wherein said factorization is compressed relative to said system of linear equations; equations; and

a storage means configured to store a portion of said factorization; and

a processor means configured to use said factorization to solve said system of linear equations to produce the strengths of one or more of said physical disturbances.

23. (Currently Amended) A method, comprising:

identifying a system of equations described by interaction data;

obtaining a plurality of far-field disturbances; and

using a computer to compute a decomposition of said interaction data wherein a sub-matrix of said decomposition is compressed, the compression of said sub-matrix is computed using only said plurality of disturbances, wherein a portion of said compressed sub-matrix is itself compressed and there are interactions in said portion that are not described by said plurality of disturbances do not describe interactions described by said portion.

24. (Previously Presented) The method of Claim 23, further comprising using said decomposition to compute a solution of said system of equations and wherein the step of using said plurality of disturbances comprises reducing a rank of a matrix of said plurality of disturbances.

25. (New) The method of Claim 2 further comprising using said decomposition to find electric charges due to a disturbance.

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26. (New) The device of Claim 17, wherein said first block contains interactions not described by said matrix of disturbances.

27. (New) The device of Claim 26, wherein a processor means uses said block-sparse decomposed matrix to find electric currents.

28. (New) The device of Claim 18, wherein said matrix of disturbances describes electromagnetic effects.

29. (New) The device of Claim 28, wherein a processor means uses said block-sparse decomposed matrix to find electric currents.

30. (New) The method of Claim 21, wherein said first matrix containing transmitted disturbances comprises a portion of a Moment Method matrix.

31. (New) The method of Claim 21, wherein said energy sources comprise electric currents and wherein said electric currents are excited, at least in part, by an electromagnetic field.

32. (New) The method of Claim 21, wherein said energy sources comprise pressure disturbances and wherein said pressure disturbances are excited, at least in part, by a pressure field.

33. (New) The device of Claim 22, wherein said physical disturbances comprises a pressure field.

34. (New) The device of Claim 22, wherein said physical disturbances comprise a particle flux.

35. (New) The device of Claim 22, wherein said physical disturbances comprise an electric current.

36 (New) The device of Claim 35, wherein said electric current is due to an electric field.

37. (New) The method of Claim 24, wherein the step of computing a solution of said system of equations comprises finding a pressure field.

38. (New) The method of Claim 24, wherein the step of computing a solution of said system of equations comprises finding an energy source.

39. (New) The method of Claim 24, wherein the step of computing a solution of said system of equations comprises finding an electric current.